

In the Claims

1. (Previously presented) A method of forming an iridium-containing film on a substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium-containing precursor that is decomposable to deposit iridium on the substrate, said method comprising decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by a process selected from the group consisting of chemical vapor deposition (CVD), assisted-CVD, ion plating, rapid thermal processing, and molecular beam epitaxy.
2. (Original) A method according to claim 1, wherein the oxidizing ambient environment comprises an atmosphere containing an oxidizing gas selected from the group consisting of oxygen, ozone, air, and nitrogen oxide.
3. (Original) A method according to claim 1, wherein the iridium deposited on the substrate comprises elemental iridium.
4. (Original) A method according to claim 1, wherein the iridium deposited on the substrate comprises iridium oxide, or a combination of iridium and iridium oxide.
5. (Cancelled)
6. (Previously presented) A method according to claim 31, wherein the coordinating Lewis base is selected from the group consisting of alkene, diene, cycloalkene, cycloalkadiene, cyclooctatetraene, alkyne, substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane.
7. (Original) A method according to claim 1, wherein the oxidizing ambient environment comprises air.
- 8.-9. (Cancelled)
10. (Previously presented) A method according to claim 32, wherein the coordinating Lewis base is selected from the group consisting of alkene, diene, cycloalkene, cycloalkadiene, cyclooctatetraene, alkyne,

substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane.

11. (Cancelled)

12. (Previously presented) A method according to claim 33, wherein the coordinating Lewis base is selected from the group consisting of alkene, diene, cycloalkene, cycloalkadiene, cyclooctatetraene, alkyne, substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane.

13. (Original) A method according to claim 1, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by chemical vapor deposition.

14. (Original) A method according to claim 1, wherein the iridium deposited on the substrate is processed to yield an iridium-containing film element on the substrate, having critical dimensional characteristics below about 0.5 micron.

15. (Original) A method according to claim 14, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by chemical vapor deposition.

16. (Previously presented) A method of forming a microelectronic device or precursor structure on a substrate, including an electrode operatively associated with a high-temperature dielectric or ferroelectric material deposited thereover, said method comprising:

(A) forming an iridium-containing film on the substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium-containing precursor which is decomposable to deposit iridium on the substrate, comprising:

(i) decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by a process selected from the group consisting of chemical vapor deposition (CVD), assisted-CVD, ion plating, rapid thermal processing, and molecular beam epitaxy; and

(ii) processing the deposited iridium into an iridium-based electrode element; and

(B) depositing on the iridium-based electrode element a high temperature dielectric and/or ferroelectric material.

17. (Original) A method according to claim 16, wherein the iridium-based electrode element has deposited thereon a high temperature dielectric material.

18. (Original) A method according to claim 16, wherein the iridium-based electrode element has deposited thereon a high temperature ferroelectric material selected from the group consisting of SBT and PZT.

19. (Original) A method according to claim 16, wherein the microelectronic device or precursor structure comprises a DRAM or FRAM capacitor device or structure.

20. (Original) A method according to claim 16, wherein the high temperature dielectric and/or ferroelectric material comprises a material selected from the group consisting of SBT, PZT, BST, PLZT, PNZT, and LCMO.

21. (Original) A method according to claim 16, wherein the iridium deposited on the substrate comprises elemental iridium.

22. (Original) A method according to claim 16, wherein the iridium deposited on the substrate comprises iridium oxide or a combination of iridium and iridium oxide.

23. (Cancelled)

24. (Previously presented) A method according to claim 34, wherein the coordinating Lewis base is selected from the group consisting of alkene, diene, cycloalkene, cyclodiene, cyclooctatetraene, alkyne, substituted alkyne (symmetrical or asymmetrical), amine, diamine, triamine, tetraamine, ether, diglyme, triglyme, tetraglyme, phosphine, carbonyl, dialkyl sulfide, vinyltrimethylsilane, and allyltrimethylsilane.

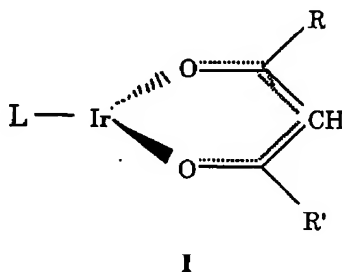
25. (Previously presented) A method according to claim 34, wherein the oxidizing ambient environment comprises air.

26. (Original) A method according to claim 16, wherein steps (A)(i), (A)(ii) and (B) are carried out in the same oxidizing ambient environment.

27.-30. (Cancelled)

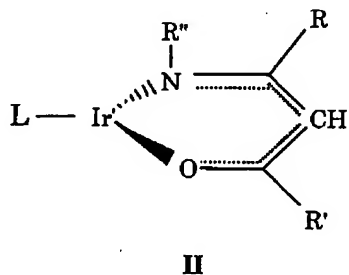
31. (Previously presented) A method of forming an iridium-containing film on a substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium-containing precursor that is decomposable to deposit iridium on the substrate, said method comprising decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment, wherein the precursor comprises a composition selected from the group consisting of:

Lewis base stabilized Ir(I) β -diketonates of formula I:



wherein R and R' may be alike or different and may be H, aryl, perfluoroaryl, C₁ - C₆ alkyl, or C₁ - C₆ perfluoroalkyl, and L is a coordinating Lewis base; and

Lewis base stabilized Ir(I) β -ketoiminates of formula II:

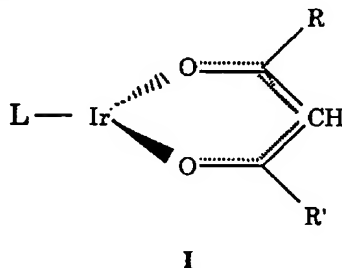


wherein R, R', and R'' are the same or different, and are independently selected from the group consisting of H, aryl, perfluoroaryl, C₁ - C₆ alkyl, or C₁ - C₆ perfluoroalkyl, and L is a coordinating Lewis base.

32. (Previously presented) A method of forming an iridium-containing film on a substrate, from an iridium-containing precursor thereof that is decomposable to deposit iridium on the substrate, said method

comprising decomposing the precursor and depositing iridium on the substrate in an oxidizing ambient environment, wherein the precursor comprises a composition selected from the group consisting of:

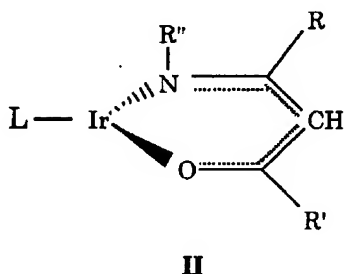
Lewis base stabilized Ir(I) β -diketonates of formula I:



wherein R and R' may be alike or different and may be H, aryl, perfluoroaryl, $[[C_1]]$ C_2 - C_6 alkyl, or C_1 - C_6 perfluoroalkyl, and L is a coordinating Lewis base.

33. (Previously presented) A method of forming an iridium-containing film on a substrate, from an iridium-containing precursor thereof that is decomposable to deposit iridium on the substrate, said method comprising decomposing the precursor and depositing iridium on the substrate in an oxidizing ambient environment, wherein the precursor comprises a composition selected from the group consisting of:

Lewis base stabilized Ir(I) β -ketoiminates of formula II:



wherein R, R', and R'' are the same or different, and are independently selected from the group consisting of H, aryl, perfluoroaryl, C_1 - C_6 alkyl, or C_1 - C_6 perfluoroalkyl, and L is a coordinating Lewis base.

34. (Previously presented) A method of forming a microelectronic device or precursor structure on a substrate, including an electrode operatively associated with a high-temperature dielectric or ferroelectric material deposited thereover, said method comprising:

(A) forming an iridium-containing film on the substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium-containing precursor which is decomposable to deposit iridium on the substrate, comprising:

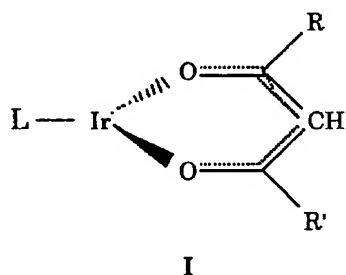
(i) decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment; and

(ii) processing the deposited iridium into an iridium-based electrode element; and

(B) depositing on the iridium-based electrode element a high temperature dielectric and/or ferroelectric material,

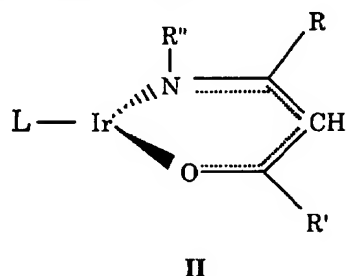
wherein the iridium-containing precursor comprises a composition selected from the group consisting of:

Lewis base stabilized Ir(I) β -diketonates of formula I:



wherein R and R' may be alike or different and may be H, aryl, perfluoroaryl, C₁ - C₆ alkyl, or C₁ - C₆ perfluoroalkyl, and L is a coordinating Lewis base; and

Lewis base stabilized Ir(I) β -ketoiminates of formula II:



wherein R, R', and R'' are the same or different, and are independently selected from the group consisting of H, aryl, perfluoroaryl, C₁ - C₆ alkyl, or C₁ - C₆ perfluoroalkyl, and L is a coordinating Lewis base.

35. (Previously presented) A method of forming an iridium-containing film on a substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium (I)-containing precursor that is decomposable to deposit iridium on the substrate, said method comprising decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by a process selected from the group consisting of chemical vapor deposition (CVD), assisted-CVD, ion plating, rapid thermal processing, and molecular beam epitaxy.

36. (Previously presented) A method of forming a microelectronic device or precursor structure on a substrate, including an electrode operatively associated with a high-temperature dielectric or ferroelectric material deposited thereover, said method comprising:

(A) forming an iridium-containing film on the substrate, comprising use of an organic solvent solution, said organic solvent solution comprising an iridium (I)-containing precursor which is decomposable to deposit iridium on the substrate, comprising:

(i) decomposing the precursor from said solution and depositing iridium on the substrate in an oxidizing ambient environment, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by a process selected from the group consisting of chemical vapor deposition (CVD), assisted-CVD, ion plating, rapid thermal processing, and molecular beam epitaxy; and

(ii) processing the deposited iridium into an iridium-based electrode element; and

(B) depositing on the iridium-based electrode element a high temperature dielectric and/or ferroelectric material.

37. (Cancelled)

38. (Previously presented) The method of claim 1, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

39. (Previously presented) The method of claim 16, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

40. (Previously presented) The method of claim 31, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

41. (Previously presented) The method of claim 34, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

42. (Previously presented) The method of claim 35, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

43. (Previously presented) The method of claim 36, wherein said organic solvent solution comprises a non-polar solvent selected from the group consisting of C₅-C₁₂ hydrocarbon alkanes and C₆-C₁₀ hydrocarbon aryls.

44. (New) The method according to claim 1, wherein the organic solvent solution comprises an organic solvent selected from C₆-C₁₂ alkane solvents, benzene, C₁-C₈ alkyl-substituted benzene solvents, toluene, carbon tetrachloride, chloroform, methylene chloride, or diethylether, tetrahydrofuran.

45. (New) The method according to claim 1, wherein if the iridium-containing precursor is cyclooctadiene adduct of Ir(I) beta-diketonate the organic solvent solution does not include an alkanolic solvent as an organic solvent.